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NOTE

INSTALLATION OF SOIL MOISTURE ACCESS TUBES IN GRAVELS AND COBBLES[1]

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A technique has been developed for installing neutron probe access tubes in soils underlain with saturated large gravels and cobbles. Conventional augers and coring devices cannot be used in this material because of the large-size aggregates and the instability of the saturated material. This method allows the access tubes to be installed in locations that would otherwise be eliminated from the study.

In a water management study in southeastern Idaho, it was necessary to determine the drainable porosity of the soils and underlying large gravels. The drainable porosity was determined from the difference in water content when saturated and when drained, based on measurements with neutron probes in aluminum access tubes. Access tubes 3.05 m (12 ft) long were installed in soils having zero to 0.61 m (2 ft) of topsoil overlying cobbles or gravels. Because of a high water table, all access tubes had to be watertight.

A common procedure for installing soil-moisture access tubes is to drive or drill a pilot hole and then insert the tube. In rocky and gravelly soils, it is difficult to maintain hole alignment for inserting the access tubes. Also, when a high water table is encountered, the pilot holes tend to collapse or fill with sand before the tube can be installed.

For this study, a method of access tube installation was devised that maintained an open hole with satisfactory alignment and assured that the access tube was waterproof and undamaged after installation. A pilot hole was driven at each location to determine whether the desired 3.66-m (12-ft) depth could be achieved. A 2.13-m (7-ft) section of 4.45-cm (1-¾-in) solid steel rod, pointed on one end, Fig. 1A, was attached to the impact hammer of a trailer-mounted Concore[3] drill rig. A 3.66-m (12-ft) length was obtained by adding a 1.52-m (5-ft) section of drill steel. This rod was driven into the gravel and was then removed, leaving a pilot hole. If the 3.66-m (12-ft) depth could not be reached, or if the pilot rod drifted out of alignment because of large rocks, another attempt was made at a new location a few feet away.

An aluminum plate was welded to the lower end of the 4.45-cm (O.D.) (1-¾-in) aluminum access tube, providing a watertight seal. This tube was then inserted inside a section of 5.08-cm (I.D.) (2-in) double-extra strong iron pipe 3.73 m (12 ft 3-in) long, as shown in Figure 1B. A disposable driving point was inserted in the lower end of the iron pipe and a removable driving head was attached to the impact hammer. The pipe was inserted into the pilot hole and driven to a 3.66-m (12-ft) depth. The iron pipe was then removed, leaving the driving point and access tube in position in the hole, Fig. 2.

The iron driving tube was raised about 15.24 cm (6 in) and the head removed to determine whether the driving point and access tube remained in place. The buoyancy effect of the underground water and the friction effect of sand particles between the access tube and the driving pipe sometimes caused the tube to rise from the hole as the driving pipe was removed. Checking the access tube for the first 0.31 to 0.61 m (1.0 to 2.0 ft) when removing the iron driving pipe was necessary to insure that the access tube stayed in place. Sometimes it was necessary to push the access tube out of the

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[3] Trade names and company names are included for the benefit of the reader and do not imply any endorsement or preferential treatment of the products listed by the U. S. Department of Agriculture.

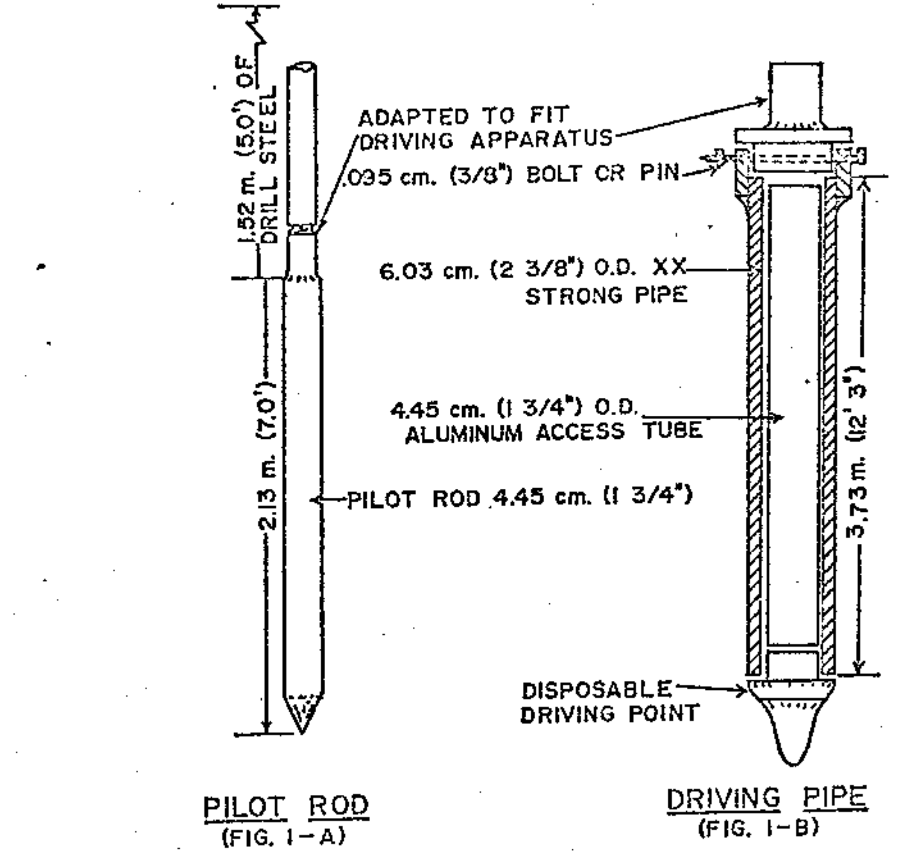

FIG. 1. Access tube installation equipment for gravel soils.

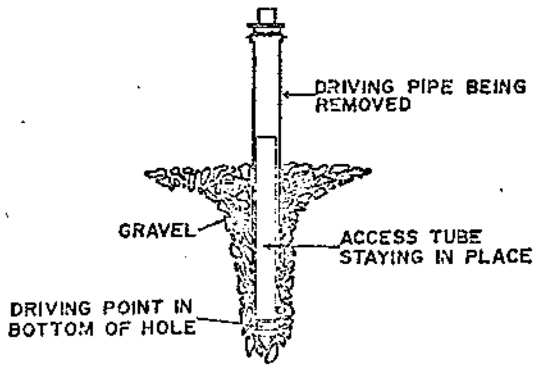

FIG. 2. Typical access tube installation.

driving pipe two or three different times until the friction between the access tube and the gravel was sufficient to hold the tube in place. The access tube became firmly anchored in the hole after it had been in place 1 or 2 days, indicating that contact with the surrounding material is adequate to obtain satisfactory moisture readings.

Moisture condensing on the insides of the closed aluminum access tubes collects in the bottom of tubes and can damage the neutron probe. To remove this water, the manifold vacuum on most automobiles or pickups can be tapped and connected, through a catch bottle, to flexible plastic tubing which is inserted into the access tube. All of the moisture that has collected in the access tube can be removed in seconds by this method.

The first installation attempted using this method was in a gravel pit where all topsoil had been removed. Access tubes were installed at 8 different sites. The first attempt usually was successful at each site; however, one site required 4 attempts. Apparently this site had a cemented gravel layer or many large boulders at the 1.83-m (6-ft) depth. The installation time for each installation, not including the time for setting up the drill rig, was 45 minutes. Time involved in removing the driving head and inspecting the tube during removal was minimal.

Total cost of the installation equipment—probe and pipe—was $23.50, including labor costs. The disposable points cost $2.50 each for labor and materials.

Access tubes can be installed in gravels with a high water table using this method, and will give reasonable values of data pertinent to the drainable porosity of gravels.